

AMMONIA

CAS Registry Number: 7664-41-7

NH₃

Molecular Formula: H₃N

Ammonia is a colorless, corrosive, alkaline gas with an extremely pungent odor. It can be liquefied by compression and will attack some forms of plastics, rubber, and coatings (HSDB, 1991). The liquid produces low temperatures by its own evaporation. Ammonia is very soluble in water, ether and chloroform, and moderately soluble in alcohol. Ammonia is a good solvent (Merck, 1989).

Physical Properties of Ammonia

Synonyms: anhydrous ammonia; ammonia gas; spirit of hartshorn; Am-Fol; Nitro-Sil

Molecular Weight:	17.03
Boiling Point:	-33.35 °C
Melting Point:	-77.7 °C
Vapor Density:	0.6 (air = 1)
Vapor Pressure:	10 atm at 25.7 °C
Density/Specific Gravity:	0.7710 g/l (water = 1)
Heat of Vaporization:	5.581 kcal/mole
Critical Temperature/Pressure:	132.4 °C/111.5 atm
Conversion Factor:	1 ppm = 0.70 mg/m ³

(HSDB, 1991; Merck, 1989)

SOURCES AND EMISSIONS

A. Sources

Ammonia is used in refrigeration, blueprinting machines, and as a neutralizing agent in the petroleum industry. It is also used in the manufacture of fertilizers, nitric acid, explosives, plastics, fuel cells, rocket fuel, synthetic fibers, dyes, and other chemicals. Emissions occur from the processing of guano, purification of refuse, sugar refining, tanneries, and in unpurified acetylene (Sax, 1987; HSDB, 1991).

The primary stationary sources that have reported emissions of ammonia in California are electric, steam and air conditioning, and petroleum refining facilities (ARB, 1997b).

Ammonia was registered for use as a pesticide, however as of January 15, 1985, it is no longer registered for pesticidal use in California (DPR, 1996).

B. Emissions

The total emissions of ammonia from stationary sources in California are estimated to be at least 20 million pounds per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Ammonia is formed naturally by the decomposition of urine and manure. It has been observed in outer space and galactic dust clouds (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of ammonia.

INDOOR SOURCES AND CONCENTRATIONS

Indoor sources of ammonia include human and pet metabolic processes, cigarette smoke, and household cleaners (Suh et al., 1994). Several studies conducted in the eastern United States found that indoor residential levels of ammonia are significantly higher than outdoor levels. Suh et al. (1994) measured ammonia levels inside 47 State College, Pennsylvania homes; the average indoor level was 19.9 parts per billion (ppb) and the average outdoor level was 1.7 ppb. Brauer et al. (1991) monitored 11 homes in Boston, Massachusetts and found average indoor ammonia levels of 19.3 ppb in the winter and 8.1 ppb in the summer; average outdoor ammonia levels were 1.1 ppb and 1.9 ppb in the winter and summer, respectively. Suh et al. (1992) monitored 24 homes in Uniontown, Pennsylvania and found an average indoor ammonia level of 21.7 ppb and an average outdoor level of 0.3 ppb.

ATMOSPHERIC PERSISTENCE

Ammonia exists in the atmosphere in the gas phase, and is subject to gas-phase reaction with photochemically-produced hydroxyl radicals, wet and dry deposition, and reaction with gaseous nitric acid (to form particulate ammonium nitrate), and with aerosols to form ammonium salts. The gas phase reaction of ammonia with the hydroxyl radical is slow, with a calculated half-life of ammonia due to gas phase reaction with the hydroxyl radical is estimated to be about 2 months (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program. Of the risk assessments reviewed as of December 1996, for non-cancer effects, ammonia contributed to the total hazard index in 15 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. Ammonia also contributed to the total hazard index in 28 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1, and presented an individual hazard index greater than 1 in 1 of these risk assessments (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to ammonia are inhalation, ingestion, and dermal contact.

Non-Cancer: Ammonia is irritating to the eyes and respiratory tract. High concentrations cause conjunctivitis, laryngitis, and pulmonary edema, possibly accompanied by a feeling of suffocation (OSHA, 1989). Persons with asthma may be particularly sensitive to exposure to ammonia.

The National Academy of Sciences has recommended a 1-hour Emergency Exposure Guidance Level (EEGL) of 71 milligrams per cubic meter (mg/m^3) (NRC-EEGL, 1987). The basis for the National Research Council (NRC)-EEGL is severe sensory irritation in human volunteers exposed to $100 \text{ mg}/\text{m}^3$.

An acute non-cancer Reference Exposure Level (REL) of 2.1×10^3 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and a chronic non-cancer REL of $100 \mu\text{g}/\text{m}^3$ for ammonia are listed in the California Air Pollution Control Officers Association Air Toxics “Hot Spots” Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoint considered for acute toxicity is respiratory irritation. The toxicological endpoints for chronic toxicity are the respiratory system and skin irritation or other effects (CAPCOA, 1993). The United States Environmental Protection Agency (U.S. EPA) Reference Concentration (RfC) of $100 \mu\text{g}/\text{m}^3$ is based on lack of pulmonary function test changes and respiratory symptoms in occupationally exposed workers compared with control workers. The U.S. EPA estimates that inhalation of this concentration or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects (U.S. EPA, 1995a).

Cancer: The International Agency for Research on Cancer and the U.S. EPA have not evaluated the carcinogenic potential of ammonia (IARC, 1987a; U.S. EPA, 1995a).

